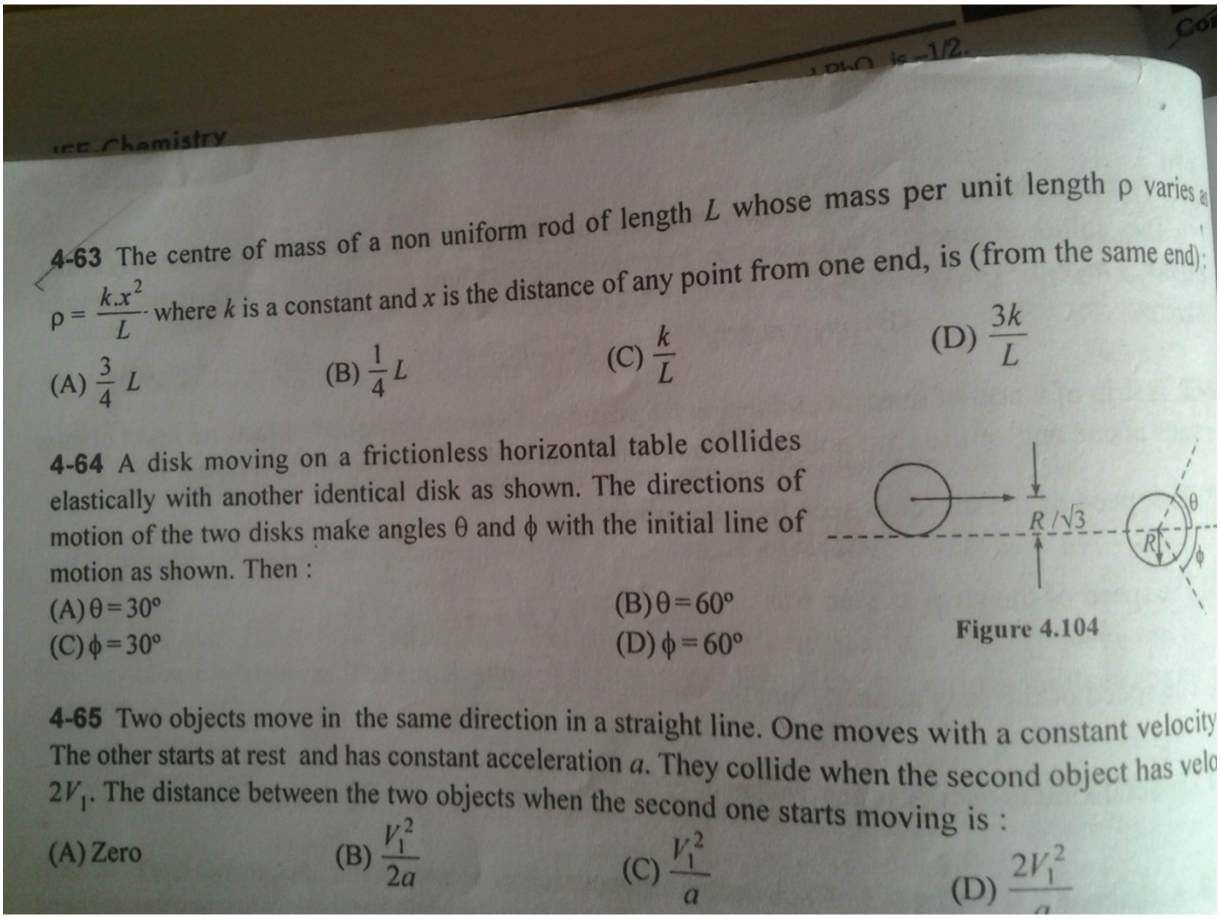
Answer on Question#56359 - Physics - Classical Mechanics



4-63 The centre of mass of a non uniform rod of length L whose mass per unit length ρ varies as $\rho = \frac{k.x^2}{L}$ where k is a constant and x is the distance of any point from one end, is (from the same end):

(A) $\frac{3}{4}L$ (B) $\frac{1}{4}L$ (C) $\frac{k}{L}$ (D) $\frac{3k}{L}$

4-64 A disk moving on a frictionless horizontal table collides elastically with another identical disk as shown. The directions of motion of the two disks make angles θ and ϕ with the initial line of motion as shown. Then :

(A) $\theta = 30°$ (B) $\theta = 60°$

(C) $\phi = 30°$ (D) $\phi = 60°$

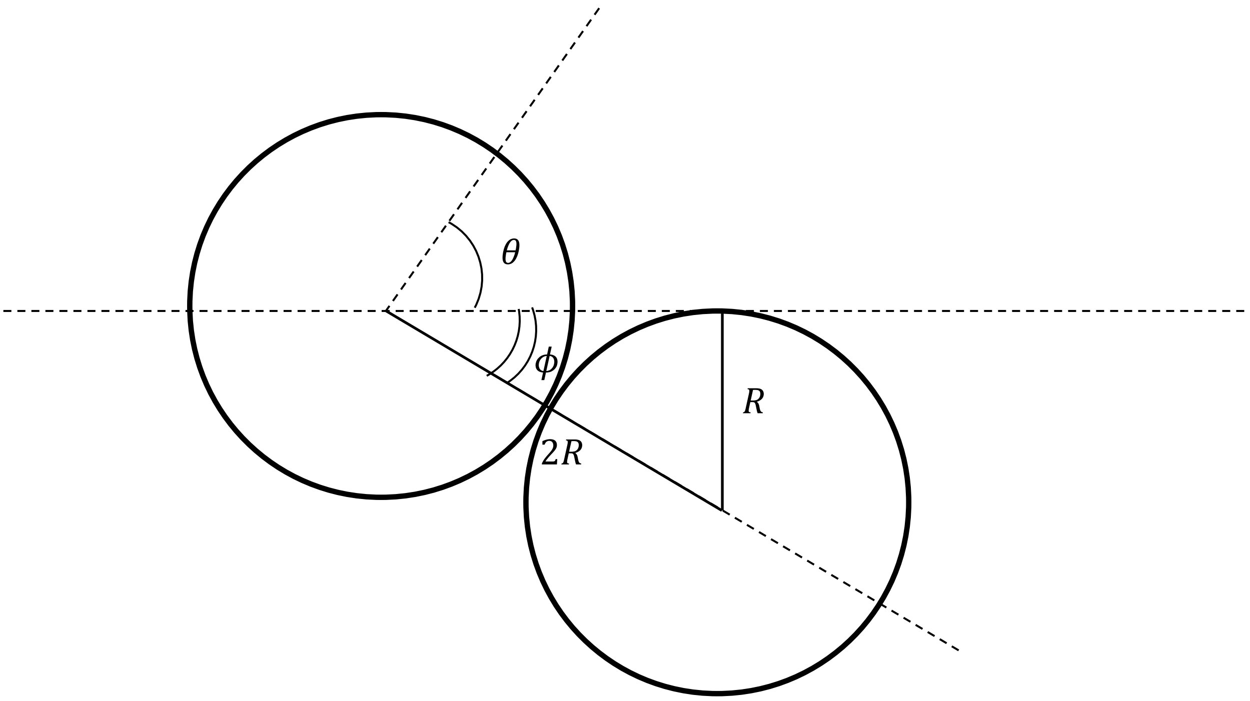
Figure 4.104

4-65 Two objects move in the same direction in a straight line. One moves with a constant velocity The other starts at rest and has constant acceleration a. They collide when the second object has velo $2V_1$. The distance between the two objects when the second one starts moving is :

(A) Zero (B) $\frac{V_1^2}{2a}$ (C) $\frac{V_1^2}{a}$ (D) $\frac{2V_1^2}{a}$

Solution:

64.



Angle θ gives the direction of motion of the first disk (which was moving before collision) after collision, and the angle ϕ gives the direction of motion of the second disk after the collision. Since the collision is elastic, the sum of these angles equals 90°.

From the above figure it's easy to see that

$$\sin\phi = \frac{R}{2R} = \frac{1}{2} \;\Rightarrow\; \phi = 30°$$

And

$$\theta = 90° - \phi = 90° - 30° = 60°$$

Thus the correct answers are (C) and (B).

65. Let the initial distance between objects be l_0, and the initial position of the accelerating object be 0. Then the dependence of position of the accelerating object on time is given by

$$x_1(t) = \frac{at^2}{2}$$

The position of the second object is

$$x_2(t) = l_0 + v_1 t$$

The time that has passed before the collision t_c and the final velocity ($v_f = 2v_1$) of the accelerating object a related by (the initial velocity v_i is zero)

$$at_c = v_f - v_i = 2v_1$$

Thus

$$t_c = \frac{2v_1}{a}$$

At time t_c they collide, i.e.

$$x_1(t_c) = x_2(t_c)$$

$$\frac{a\left(\frac{2v_1}{a}\right)^2}{2} = l_0 + v_1\frac{2v_1}{a}$$

$$l_0 = 0$$

Therefore the correct answer is (A).

Answer:

64. (B), (C)
65. (A)